इंटरनेट मानक

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Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

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IS 4247-2 (1992): Code of Practice Structural Design of Hydroelectric Power, Part 2: Superstructure [WRD 15: Hydroelectric Power House Structures]

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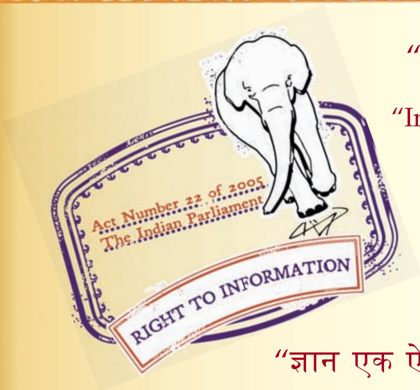



"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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भारतीय मानक

# सतह पन-बिजलीघर की संरचना-डिज़ाइन की भारतीय मानक रीति संहिता का मसौदा

भाग 2 अधिसंरचना

( दूसरा पुनरीक्षण )

*Indian Standard*

# CODE OF PRACTICE FOR STRUCTURAL DESIGN OF SURFACE HYDROELECTRIC POWER STATION

## PART 2 SUPERSTRUCTURE

*( Second Revision )*

UDC 627·8·04 : 621·311·2 : 624·9



BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

*April* 1992 Price Group 3

# AMENDMENT NO. 1 JANUARY 2008
# TO
# IS 4247 (PART 2) : 1992 CODE OF PRACTICE FOR STRUCTURAL DESIGN OF SURFACE HYDROELECTRIC POWER STATION

## PART 2 SUPERSTRUCTURE

*( Second Revision )*

(*Page* 1, *clause* 4) — Substitute 'IS 4247 (Part 1) : 1993' *for* 'IS 4247 (Part 1) : 1984'.

(*Page* 1, *clause* 5.3) — Substitute 'IS 456 : 2000' *for* 'IS 456 : 1978'.

(*Page* 2, *clause* 9.1) — Substitute 'IS 456 : 2000' *for* 'IS 456 : 1978'.

(*Page* 3, *clause* 10.4) — Substitute 'IS 1346 : 1991' *for* 'IS 1346 : 1976', and 'IS 3036 : 1992' *for* 'IS 3036 : 1980' respectively.

(*Page* 4, *clause* 11.3.4) — Substitute 'IS 456 : 2000' *for* 'IS 456 : 1978'.

(*Page* 6, *clause* 16.2) — Substitute 'IS 456 : 2000' *for* 'IS 456 : 1968'.

(*Page* 6, *Annex* A) — Substitute:

a) 'IS 456 : 2000 Plain and reinforced concrete — Code of practice (*fourth revision*)' *for* 'IS 456 : 1978 Code of practice for plain and reinforced concrete (*third revision*)'.

b) 'IS 1346 : 1991 Code of practice for water proofing of roofs with bitumen felts (*third revision*)' *for* 'IS 1346 : 1976 Code of practice for water-proofing of roofs with bitumen felts (*second revision*)'.

c) 'IS 3036 : 1992 Code of practice for laying lime concrete for water-proofed roof finish (*second revision*)' *for* 'IS 3036 : 1980 Code of practice for laying lime concrete for a waterproofed roof finish (*first revision*)'.

d) 'IS 3067 : 1988 Code of practice for general design details and preparatory work for damp-proofing and water-proofing of buildings (*second revision*)' *for* 'IS 3067 : 1980 Code of practice for general design, detail and preparatory work for damp-proofing and water-proofing of buildings (*first revision*)'.

e) 'IS 4247 (Part 1) : 1993 Code of practice for structural design of surface hydroelectric power stations : Part 1 Data for design (*third revision*)' *for* 'IS 4247 (Part 1) : 1984 Code of practice for structural design of surface hydroelectric power stations : Part 1 Data for design'.

(*Page* 6, *Annex* A) — Insert 'IS 4971 : 1968 Recommendations for selection of industrial floor finishes' at the appropriate place.

(WRD 15)

Reprography Unit, BIS, New Delhi, India

## FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Hydroelectric Power House Structures Sectional Committee had been approved by the River Valley Division Council.

Preliminary design of hydel power station generally consists of study of alternative schemes and cost estimates for different site arrangements. The next stage usually involves detailed planning consisting of comparative studies of different designs and arrangements of plants for the finally agreed site and operating conditions. The final stage of design is normally concerned with the structural design and building details, therefore orderly design procedure in the initial stages saves time in the long run and avoids replanning and difficult structural problems later on.

Design of superstructure of a hydro power station is an important item and requires considerable attention. For maximum economy, judicious selection of a particular type of superstructure and its components amongst the various types in vogue, is essential. This standard is intended to help the designer in designing surface hydro power station for the loads likely to come on them during construction, erection, operation, maintenance and repair. This code of practice represents a standard of good practice and, therefore, takes the form of recommendations.

This standard has been published in three parts, Part 1 covers data for design while Part 3 covers substructures.

This standard ( Part 2 ) was first published in 1968 and subsequently revised in 1978. The present revision has been made in view of the experience gained during the course of these years in use of this standard. The major modifications in this revision are in respect of design criteria. Construction details for galvanized corrugated steel sheet roofs design of columns and clause on choice amongst various types of girders have been deleted. Also additional information regarding floor finishes have been included.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values ( *revised* )'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

# Indian Standard

# CODE OF PRACTICE FOR STRUCTURAL DESIGN OF SURFACE HYDROELECTRIC POWER STATION

## PART 2 SUPERSTRUCTURE

## ( Second Revision )

## 1 SCOPE

This standard ( Part 2 ) covers types, layout and the structural design of superstructure of a surface hydroelectric power house.

## 2 REFERENCES

The Indian Standards listed in Annex A are necessary adjuncts to this standard.

## 3 TERMINOLOGY

**3.0** For the purpose of this standard, the following definition should apply.

### 3.1 Superstructure

The portion of power house extending from turbine floor/generator floor right up to the top including gantry columns, roofs, walls, etc.

## 4 DESIGN

The data to be collected for the design of a surface hydro power station should be in accordance with IS 4247 ( Part 1 ) : 1984.

## 5 MATERIALS

### 5.1 Structural Steel

The structural steel should conform to IS 2062 : 1984 or IS 226 : 1975 and IS 8500 : 1977.

### 5.2 Reinforcement

The reinforcement steel should conform to IS 432 ( Part 1 ) : 1982 or IS 1786 : 1985.

### 5.3 Concrete

The concrete should conform to IS 456 : 1978. Minimum M 20 grade of concrete should be used where structure comes in contact with water.

### 5.4 Galvanized Corrugated Steel Sheets

Galvanized corrugated steel sheets should conform to IS 277 : 1985.

## 6 TYPES AND LAYOUT OF SUPERSTRUCTURE

**6.1** The superstructure of surface hydel power house can be, generally, classified into the following types:

a) *Outdoor Types* — The power house in which generators, exciters, etc, are provided with local steel housings for weather protection but are otherwise fully exposed above the intermediate structure. They require travelling gantry cranes for the erection and maintenance of the units.

b) *Semi-outdoor Type* — The power house has a low roof or deck immediately over the generators. The height not being sufficient to house the overhead travelling crane. The erection and maintenance of machine is done through hatches provided in the roof.

c) *Indoor Type* — This type of power house has a superstructure high enough to accommodate the overhead travelling crane. In this case all the erection and maintenance of the machinery is done inside the building.

**6.2** The factors generally influencing the choice of the types of superstructures are, site topography, approach road level, tail water level, weather conditions, type of machine, security, economy and aesthetics.

**6.3** Important aspects in the layout of superstructure are positioning of gantry columns, fixing their heights and selection of suitable roofing system. The layout of gantry columns is affected to quite an extent by the transverse joints provided in the substructure. Twin columns should normally be provided at places where a joint occurs in the substructure. The location of gantry columns is also influenced by the following:

a) Availability of space for foundations which would depend upon the layout of the scroll case and the openings in the substructure; and

b) The likely size of gantry girder.

**6.3.1** The height of columns should be such that the crane hook in its highest position is able to handle the biggest machine part with other machines remaining undisturbed. Also the clearance of hook over the erection bay floor level should be enough for the biggest machine part to be unloaded from the trailer. Suitable arrangement should be made for detanking of transformers but increasing the height of machine hall for this reason alone is not desirable.

## 7 ELEMENTS OF SUPERSTRUCTURE

**7.1** The superstructure of a power house generally consists of the following elements:

a) Roof,

b) Roof supports,

c) Gantry girder,

d) Gantry columns,

c) Beams or braces,

f) Panel walls,

g) Floors, and

h) Auxiliary rooms and service bay and unloading bay when they form part of main power house.

## 8 DESIGN LOADS AND FORCES

### 8.1 Dead Loads

These should consist of self load of the structure and the permanent superimposed loads.

### 8.2 Live Loads

The live loads for roof and floors should be taken in accordance with IS 875 (Part 2) : 1987 respectively.

### 8.3 Wind Load

Wind load should be taken in accordance with IS 875 ( Part 3 ) : 1987.

**8.4** Snow load should be taken in accordance with IS 875 ( Part 4 ) : 1987 wherever applicable.

### 8.5 Crane Loads

Crane loads should be considered in accordance with IS 4247 ( Part 1 ) : 1978.

### 8.6 Earthquake Forces

These should be considered in accordance with IS 1893 : 1984.

### 8.7 Water Pressure and Earth Pressure

Appropriate values of these forces under static and dynamic conditions should be considered where applicable as per IS 1893 : 1984.

### 8.8 Temperature Effects

The total temperature variation in structure should be considered as two-thirds of the average maximum annual variation in temperature. The structure should be designed to withstand stresses consequent to + half the total temperature variations.

NOTE — The maximum annual variation for this purpose should be taken as the difference between the mean of the daily minimum temperatures during the coldest month of a year and the mean of the daily maximum temperatures during the hottest month of the year.

### 8.9 Special Loads

If the superstructure of the power station is to be subjected to any other load not covered in **8.1** to **8.8** due to its special use, such as switch yard, transmission cable connected to columns, etc, appropriate additional loads should also be considered.

NOTE — The design based on the above loads ( **8.1** to **8.8** ) should also be checked for erection and construction loads and crane testing load.

## 9 STRESSES

### 9.1 Permissible Stresses

The permissible stresses should be taken in accordance with IS 456 : 1978 for concrete and reinforcement and IS 800 : 1984 for structural steel.

Reduction in permissible stresses, if any, for components of power house in contact with water may be decided by the designer.

### 9.2 Increase in Permissible Stresses for Various Load Combinations

The design of superstructure should be checked for the combination of loads given in Table 1 with the corresponding increase in permissible stresses.

### 9.3 Fatigue Considerations

Steel members and their connections subjected to fluctuations of stresses should be designed according to permissible stresses given in IS 807 : 1976. The increase in permissible stresses should, however, remain the same as given in **9.2**.

## 10 ROOF

### 10.1 Type of Roofs

The roof may be galvanized corrugated steel sheets or of reinforced concrete, precast or cast *in-situ*. In the case of galvanized corrugated sheet roof the supporting member may be a steel truss of a gable steel frame whereas in the case of latter it may either be a steel truss or beam or a reinforced concrete beam arch or a gable frame.

**Table 1 Permissible Increase in Stresses for Various Load Combinations**

( *Clause* 9.2 )

| Sl No. | Load Combinations | Permissible Increase in Stresses |
|---|---|---|
| (1) | (2) | (3) |
| i) | Dead load, live load, moving crane loaded to half its capacity and normal tail water level | 0 percent |
| ii) | Dead load, live load, standing crane load to its full capacity and normal tail water level | 0 percent |
| iii) | Dead load, live load, moving crane loaded to half its capacity, wind, temperature and normal tail water level | 25 percent |
| iv) | Dead load, live load moving crane loaded to full capacity, temperature and normal tail water level | 25 percent |
| v) | Dead load, live load, unloaded standing crane, temperature, earthquake and normal annual tail water level | 33⅓ percent |
| vi) | Dead load, live load, moving crane loaded to half its capacity, temperature and tail water level corresponding to design flood | 33⅓ percent |
| vii) | Dead load and temporary or construction loads | 25 percent |

NOTES

1 Live loads should be as specified in IS 4247 ( Part 1 ) : 1984. Wind seismic and crane loads have been considered as distinct from the live loads in the above table. While considering earthquake, live loads may be suitably modified in accordance with IS 1893 : 1984.

2 In case where there are some special conditions of loading particular to a power station as specified in **8.8** other than those mentioned in the above table, the same should also be accounted for appropriately.

3 For rivets, bolts, tension rods, the permissible stresses should be increased by 25 percent only.

**10.1.1** *Galvanized Corrugated Sheet Roof*

Generally, the galvanized corrugated sheets of the roof are fixed on purlins supported on the roof members. The gauge of the galvanized corrugated sheet should depend on the load and the spacing of the purlins or else the spacing of the purlins and rafters will have to be fixed to suit a particular gauge for given design loads. However, the thickness of corrugated sheet should be not less than 1·25 mm.

**10.1.2** *Reinforced Concrete Roof*

The reinforced concrete roof can either be precast or cast *in situ*. The distance between the two adjacent roof supporting members may be, sometimes too large for slab to directly span the gap. It may generally be desirable to connect the roof members either by purlins or cross members or to use ribbed or any other suitable type of precast slabs.

**10.2 Choice of the Type of Roof**

The choice of the type of roof primarily depends upon its use and the available construction facilities, time available for construction and the economics; the secondary consideration being architectural appearance.

**10.3 Slope of Roof**

The slope of the roof should be as specified in **10.3.1** and **10.3.2**.

**10.3.1** *Galvanized Corrugated Sheet Roofing*

The slope of the roof should depend upon the type of truss to be used. Generally, a roof slope may be from 1/4 to 1/10.

**10.3.2** *Reinforced Cement Concrete Roofing*

A minimum slope of 1 in 120 should be provided for proper drainage of roof.

**10.4 Waterproofing**

Waterproofing of roof should be carried out in accordance with the relevant Indian Standards ( *see* IS 1346 : 1976, IS 3036 : 1980, IS 3067 : 1988 and IS 4365 : 1967 ).

## 11 ROOF SUPPORTS

**11.1 Type of Roof Supports**

Power house roof supports in general are either of steel or concrete. In either case it should be an integral part of a transverse frame. Its connection with the upstream and downstream columns may generally be hinged or fixed depending upon the type of construction.

**11.1.1** *Steel*

Steel roof support may either be a beam fixed to the steel columns or a steel truss pin jointed to the columns. In either case the top of roof support may be flat or sloping depending upon the type of covering. In case of steel truss the columns may either be of steel or concrete.

**11.1.2** *Concrete*

Concrete roof support may either be an arch or a concrete beam fixed to the concrete columns resulting in a frame. In case of beams, the top may either be flat or sloping.

NOTE — Sometimes the construction of the concrete beam at considerable height can be facilitated by the provision of steel truss at the top of gantry columns to support the formwork and working platform. This steel truss which should be properly designed for construction loads, should be embedded in concrete and may form a part of reinforcement of the concrete beams.

**11.2 Choice of Type of Roof Supports**

The choice of type of roof support depends on local weather conditions, construction equipment facility, time needed for construction, types of gantry columns, whether steel or concrete, and economics.

**11.3 Structural Design**

The roof supporting member should be designed as part of the superstructure frame consisting of roof supporting member, gantry columns, beams, walls and the floors, if they form a part of the frame.

**11.3.1** *Steel Truss*

**11.3.1.1** *Spacing*

The spacing of roof trusses is governed by the spacing of columns which is fixed from other considerations and limitations.

**11.3.1.2** *Camber*

For better appearance a camber in the bottom chords of roof trusses is desirable. Camber should be limited to 1/40 of the span as cambering the lower chord more than 1 in 40 would considerably add to the weight of the truss.

**11.3.1.3** *Bracing*

Suitable bracing should be provided both in end and intermediate panels of each bay of the power house as follows:

a) *End panels* — Suitable diagonal and longitudinal bracings should be provided both in the plane of top chords if purlins are not provided. In case purlins are provided longitudinal bracings in the plane of top chord should be dispensed with.

b) *Intermediate panels* — Suitable diagonal bracing should be provided both in the plane of top and bottom chords if purlins are not provided. In case purlins are provided, diagonal bracing in the plane of top chord should be dispensed with.

**11.3.2** *Steel Girder*

The steel girder should preferably be a welded structure. These should be provided with suitable diagonal bracing in the end panels when purlins are provided. In case purlins are not provided diagonal bracing should be provided in all panels.

**11.3.3** The frame consisting of steel gantry columns with top steel girder fixed at ends should be analysed as a portal frame. The top steel beam should be designed for bending moment, shear force and thrust obtained from the frame analysis. The design should be done in accordance with IS 800 : 1984.

**11.3.4** *Concrete Beam*

In this case a frame similar to that given in **11.3.3** should be analysed and concrete beam should be designed for the moment, thrust and shear force in accordance with IS 456 : 1978.

NOTE — In cases where steel truss is embedded in concrete beam for facility of construction, the beam section containing steel truss and reinforcement bars should be checked for final loads ignoring the initial stresses in the truss due to construction load ( *see* Note under **11.1.2** ).

## 12 GANTRY GIRDERS

**12.1 Type of Girders**

The gantry girders may be either of the following types:

a) *Steel*
   1) Plate girder,
   2) Lattice girder, and
   3) Box girder.

b) *Concrete*
   1) Reinforced cement concrete, and
   2) Prestressed cement concrete.

**12.2 Arrangement of Gantry Girder**

**12.2.1** Gantry girders may either be supported on brackets connected to the column or on steps provided in the columns at a level determined by crane clearance, etc.

**12.2.2** *Seating for Gantry Girder*

**12.2.2.1** *Steel girder*

The steel girder may either be simply supported or continuous over the gantry columns. There should be clear joints in the girder at the locations of expansion joints. In either case the girder should be supported on suitably formed seats, which generally consist of a bearing plate welded to the top of the steps in the column. The load from the girder to the column is transferred either through the bottom flange of the girder, in case sufficient bearing area is available, or through a bearing plate welded to the underside of the plate girder. In either case the bearing surface should be suitably machined. The girder should be secured to the columns suitably. Provision should be made, where necessary, to permit longitudinal movement due to temperature variation and deflection. The girder should normally be connected to the column near the top flange in each case in order to restrain it from lateral bending and twisting at the support.

12.2.2.2 *Concrete girder*

Concrete girders should normally form an integral part of the longitudinal frame along with columns between two expansion joints.

12.2.3 *Buffer Stops*

At the end of crane runways, suitable buffer stops should be provided to withstand the maximum crane striking force as specified by the crane suppliers. Buffer stops should be provided with suitable cushion pads to act as shock absorber. A limiting switch should be provided in front of the buffer stops.

**12.3 Structural Design**

12.3.1 Gantry girders should be subjected to moments, shear force and thrust transmitted to it by the longitudinal frame analysis in which the crane loads are positioned to give the worst effect. In addition to the above, the girder should also be subjected to horizontal loads. As such the girders should be designed as members in biaxial bending, torsion and direct thrust according to the relevant Indian Standard.

## 13 GANTRY COLUMNS

**13.1 Type of Columns**

The gantry columns of a surface hydroelectric power houses may be of steel, concrete or both.

**13.2 Choice of Type of Columns**

The selection of a particular type of column depends upon construction equipment facility, construction schedule, availability of materials and aesthetics.

**13.3 Structural Design**

13.3.1 The design of gantry columns necessarily consists in analysing a space frame consisting of upstream and downstream gantry columns located in between two expansion joints, roof supporting member at the top of columns and any other structural members connected with gantry columns.

NOTE — For simplicity, this space frame may be analysed by splitting it up into separate transverse and longitudinal frames. However, the results obtained from a two-dimensional analysis should normally be used for preliminary dimensioning. The final design may be based on a comprehensive three-dimensional analysis.

13.3.2 A judicious disposition of various loads for the combinations specified in 9.2 is necessary to ensure required safety and economy in the design of structure.

13.3.3 *Column Foundations*

The column foundations in case of surface hydroelectric power houses may sometimes be laid on edges of mass concrete. Keeping the above into consideration the column foundations should be so designed as to limit the pressures below the base to safe bearing values of mass concrete and to ensure such rigidity and restraints as have been allowed for in the design of superstructure including resistance to all horizontal forces.

13.3.3.1 *Steel columns*

In case of steel columns the base plate of the column should be so dimensioned as to satisfy the bearing pressure requirement. The base plate of the column should be so fixed to the foundation concrete as to comply with IS 800 : 1984. If the steel column is placed on edge of mass concrete the procedure described for edge load treatment in case of concrete columns ( *see* 13.3.4.2 ) should also be applied.

13.3.3.2 *Concrete columns*

In case of concrete columns, the mix used is sometimes of high compressive strength and of mass concrete on which the columns are to be founded is of comparatively less strength. In order that the mass concrete of the substructure may be able to withstand such high stresses, a pocket whose dimensions should be increased from those of columns in the ratio of compressive strength of column and mass concrete should be provided and suitably reinforced. The depth of this rich concrete should be found out after applying the edge load theory. The column should be treated as concentrated load placed on the edge of mass concrete.

## 14 BEAMS OR BRACES

**14.1 Functions**

The beams and braces are provided to stiffen the columns in the longitudinal and transverse direction. Cross beams also provide support to the panel walls. The probable locations for the provision of cross beams are the various floor and gantry girder levels and at about 4 to 5 metres vertical spacing in the remaining portion of the column, with one at level of truss.

**14.2 Choice of Type**

Cross beams may be either of steel or concrete. The choice will mainly depend upon the type of columns. In case the adoption of concrete cross beams with concrete columns presents constructional difficulties, steel beams may be used provided they are rigidly connected to the columns. Braces are, generally, of steel and are provided with steel columns.

**14.3 Design**

The cross beams should be treated as part of the longitudinal and transverse frame and should then be designed for the moments, and thrusts obtained from frame analysis, as well as for other loads coming over them.

## 15 PANEL WALLS

15.1 Panel walls may be of reinforced cement concrete, precast concrete blocks, reinforced brickwork.

**15.2** The choice between concrete and masonry chiefly depends upon the availability of material, economy and the expediency in construction. The choice will differ from place to place.

**15.3** The panel walls should be designed according to the conditions of their fixity with the columns and/or cross beams. Reinforcement interrupted by openings should be concentrated on its sides together with additional steel equivalent to steel interrupted. In addition inclined bars should be provided at the corners.

**15.4** It is not desirable to embed pipes having fluids at pressure greater than 10 kg/cm² and/or temperature higher than 65°C. Embedded pipes should be placed in the middle third of wall and their outer diameter should not normally exceed 20 percent of the wall thickness or else the wall should be adequately reinforced.

**16 FLOORS**

**16.1** The layout of the various floors in the power house is decided along with the general layout of power house and it is not possible to codify it since it should be specific to every power house.

**16.2** The design of floors in a power house is akin to the design of floor in a general building which is covered in IS 456 : 1968 for concrete members and IS 800 : 1984 for steel members.

**16.3 Floor Finishes**

The type of floor finishes for different floors in the surface hydro power house depends upon the aesthetics, type of loading, extent of wear and the specific use to which a particular floor is put to.

**16.3.1** The use to which the floor finishes in various locations of power house is likely to be put will determine the specifications of the finish for which IS 4971 : 1968 may be referred. For general guidance, the following are given below:

a) *Service Bay*
   i) Erection floor-ironite/granolithic flooring.
   ii) Other floors-cement concrete flooring.

b) *Machine Hall Floors*
   i) Generator floor-ironite/granolithic.
   ii) Turbine floor-cement concrete flooring.

c) *Auxiliary Block*
   i) Control room — ceramic tiles/PVC tiles.
   ii) Office block — Terrazo flooring.
   iii) Battery room — Acid resistant flooring, etc.

The above mentioned floor finishes should conform to relevant IS Codes of practice.

# ANNEX A

( *Clause* 2.1 )

## LIST OF REFERRED INDIAN STANDARDS

| *IS No.* | *Title* |
|---|---|
| 226 : 1975 | Specification for structural steel ( standard quality ) |
| 277 : 1985 | Specification for galvanized steel ( plain and corrugated ) ( *second revision* ) |
| 432 ( Part 1 ) : 1982 | Specification for mild steel and medium tensile steel bars and hard-drawn steel wire for concrete reinforcement : Part 1 Mild steel and medium tensile steel bars ( *third revision* ) |
| 456 : 1978 | Code of practice for plain and reinforced concrete ( *third revision* ) |
| 800 : 1984 | Code of practice for general construction in steel ( *second revision* ) |
| 807 : 1976 | Code of practice for design, manufacture, erection and testing ( structural portion ) of cranes and hoists ( *first revision* ) |
| 875 ( Part 2 ) : 1987 | Code of practice for design loads ( other than earthquake ) for buildings and structures : Part 2 Imposed loads ( *second revision* ) |
| 875 ( Part 3 ) : 1987 | Code of practice for design loads ( other than earthquake ) for buildings and structures : Part 3 Wind loads ( *second revision* ) |
| 1346 : 1976 | Code of practice for waterproofing of roofs with bitumen felts ( *second revision* ) |
| 1786 : 1985 | Specification for high strength deform d steel bars and wires for concrete reinforcement ( *third revision* ) *Superseding* IS 1139 : 1966 |
| 1893 : 1984 | Criteria for earthquake resistant design of structures ( *fourth revision* ) |
| 2062 : 1984 | Specification for weldable structural steel ( *third revision* ) |
| 3036 : 1980 | Code of practice for laying lime concrete for a waterproofed roof finish ( *first revision* ) |
| 3067 : 1980 | Code of practice for general design, detail and preparatory work for damp-proofing and water proofing of buildings ( *first revision* ) |
| 4247 ( Part 1 ) : 1984 | Code of practice for structural design of surface hydroelectric power stations : Part 1 Data for design |
| 4365 : 1967 | Code of practice for application of bitumen mastic for waterproofing of roofs |
| 4461 : 1979 | Code of practice for joints in surface hydro-electric power stations ( *first revision* ) |
| 8500 : 1977 | Weldable structural ( medium and high strength qualities ) |

**Standard Mark**

The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

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